S/N Unknown **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	John Whitman	Examiner: Unknown
Serial No.:	Unknown	Group Art Unit: Unknown
Filed:	Herewith	Docket: 303.254US4
Title:	A SOLVENT PREWET AND METHOD TO DISPENSE THE SOLVENT PREWET	

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Before taking up the above-identified application for examination, please enter the following amendments.

IN THE DRAWINGS

Enclosed is a copy of Figure 1 of the drawings showing the following proposed amendment to Figure 1 in red ink.

The proposed amendment is to include the legend PRIOR ART to Figure 1 as it illustrates a conventional track coating unit.

IN THE ABSTRACT OF THE DISCLOSURE

Please substitute the Abstract in the appendix entitled Clean Version of Abstract for the previous Abstract. Following is a marked-up version of the Abstract:

A method and apparatus is provided for more [efficiently] efficient application of photoresist to a wafer surface. One aspect of the method comprises applying solvent to the wafer and spinning it to coat the entire wafer surface prior to the application of photoresist. This reduces surface tension on the wafer and reduces the amount of resist required to achieve a high quality film. The apparatus comprises adding a third solenoid and nozzle to the coating unit to accommodate the application of solvent to the center of the wafer surface. The method also describes incorporating a new solvent comprising [Di-Acetone Alcohol] diacetone alcohol, which is a low-pressure solvent, providing extended process latitudes and reduced material expenditures.

IN THE SPECIFICATION

On page 1, after the title, please insert the following paragraph:

This application is a Divisional of U.S. Application No. 09/650,876, filed August 30, 2000, which is a Continuation of U.S. Application No. 08/974,015, filed November 19, 1997, now U.S. Patent No. 6,147,010, which is a File-Wrapper Continuation of U.S. Application No. 08/749,001, filed November 14, 1996, abandoned.

Please make the paragraph substitutions indicated in the appendix entitled Clean Version of Amended Specification Paragraphs. The specific changes incorporated in the substitute paragraphs are shown in the following marked-up versions of the original paragraphs:

The paragraph beginning at page 3, line 28 is amended as follows:

The photoresist is deposited on each wafer after the wafer is mounted in the process bowl of a track coating unit. One partial solution to controlling the amount of solvent (and other photoresist materials) used is to use a chemical dispensing unit which provides tighter control over the amount of solvent deposited on any one wafer. One such system is described in European Patent 618,504, issued to Hasebe. Hasebe describes a system employing a specialized dispensing head which has a single nozzle for dispensing solvent and a single nozzle for dispensing resist solution. Hasebe controls where the material is dispensed on the wafer by moving the dispense head to different locations relative to the wafer. The system disclosed in Hasebe requires, however, a number of specialized devices, including a moveable dispense head, a pump for the solvent and a temperature adjustment mechanism. This type of system reduces the waste of solvent resulting from over-application, as well as increasing wafer-to-wafer consistency due to the more accurate dispensing of the material. This is only a partial solution, however, because even though a variety of units for dispensing chemicals in this manner are marketed, the units <u>are</u> designed for low volumes of low viscosity fluids. In addition, each unit is a specialized system, so when a shop wishes to employ such a method the shop has to retrofit or replace existing equipment. This results in reduced production flow, and overhead costs are significantly increased.

The paragraph beginning on page 7, line 15 is amended as follows:

Conventional processes primarily employ a three-component photoresist, with either ethyl lactate (EL) or propyleneglycol monomethylether acetate (PGMEA) as the preferred solvent component. Both of these substances have a rather high evaporation rate, however, which shrinks the process control window. To compensate, conventional systems use more photoresist as well as a greater percentage of solvent to total photoresist volume. In contrast, according to one aspect of the present invention, a low vapor-pressure solvent is used. In one embodiment a mixture of aliphatic esther and diacetone alcohol is used as the solvent component. The ratio of the materials can range from 10% esther and 90% alcohol, to 30% esther [to] and 70% alcohol. The dissipation rate of this solvent is significantly reduced over conventional solvents because diacetone alcohol has a heavier molecule, creating a very low pressure solvent. The rate of evaporation is up to ten times lower than that of the conventional solvents. One direct result is that semiconductor processing incorporating this type of solvent requires very little solvent to achieve very good resist thickness profiles. With the diacetone alcohol solvent, the process uses as little as 0.3-1.0 cc solvent prewet solution per wafer (as compared to 1.0 cc or greater solvent solution per wafer).

IN THE CLAIMS

Please cancel claims 1-12 after adding the following new claims:

13. (New) An apparatus, comprising:

a solvent dispense head in fluid communication with a source of a photo resist solution and in fluid communication with a solvent source containing a solvent that includes diacetone alcohol; and

a rotatable wafer-holding mechanism; and

a logic control unit adapted for executing a process to coat a wafer, wherein the process comprises:

distributing the solvent on a wafer surface; and

upon distributing the solvent, distributing the photo resist solution on the wafer surface.

14. (New) The apparatus of claim 13, wherein the solvent dispense head includes:

a first nozzle and a second nozzle in fluid communication with the source of photo resist solution; and

a third nozzle in fluid communication with the source of solvent.

15. (New) The apparatus of claim 13, wherein, in the process performed by the logic control unit, distributing the solvent on the wafer surface comprises:

dispensing the solvent on the wafer surface; and

actuating the rotatable wafer-holding mechanism to spin the wafer until the prewet solvent is distributed across the wafer surface.

16. (New) The apparatus of claim 13, wherein, in the process performed by the logic control unit, distributing the photo resist solution on the wafer surface comprises:

dispensing the photo resist solution on the wafer; and

actuating the rotatable wafer-holding mechanism to spin the wafer until the photo resist solution is distributed across the wafer surface.

17. (New) The apparatus of claim 13, wherein the process performed by the logic control unit further comprises dispensing the solvent for edge bead removal after distributing the photo resist solution on the wafer surface.

18. (New) The apparatus of claim 13, wherein:

the photo resist solution comprises a resin, a photoactive compound and a photo resist solvent; and

the photo resist solvent contained within the photo resist solution includes the solvent from the solvent source.

19. (New) An apparatus, comprising:

a solvent dispense head in fluid communication with a source of a photo resist solution and in fluid communication with a solvent source containing a solvent that includes diacetone

alcohol and aliphatic esther; and

a rotatable wafer-holding mechanism; and

a logic control unit adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the solvent on a wafer surface;

actuating the rotatable wafer-holding mechanism to spin the wafer until the solvent is distributed across the wafer surface;

upon distributing the solvent, dispensing the photo resist solution on the wafer surface; and

actuating the rotatable wafer-holding mechanism to spin the wafer until the photo resist solution is distributed across the wafer surface.

20. (New) The apparatus of claim 19, wherein:

the solvent dispense head includes a nozzle in fluid communication with the solvent source; and

in the process performed by the logic control unit, dispensing the solvent on a wafer surface includes dispensing the solvent from the third nozzle.

21. (New) The apparatus of claim 19, wherein:

the solvent dispense head includes:

a first nozzle in fluid communication with the source of photo resist solution;

a second nozzle in fluid communication with the source of photo resist solution; and

a third nozzle in fluid communication with the solvent source that includes diacetone alcohol; and

in the process performed by the logic control unit, dispensing the solvent on a wafer surface includes dispensing the solvent from the third nozzle, and dispensing the photo resist solution on the wafer surface includes dispensing the photo resist solution from the first nozzle and the second nozzle.

22. (New) The apparatus of claim 19, wherein:

the solvent head includes:

a first nozzle directed at the edge and sides of the wafer;

a second nozzle directed at the back of the wafer; and

a third nozzle directed at the center of the wafer; and

in the process preformed by the logic control unit, dispensing the solvent on a wafer surface includes dispensing the solvent from the third nozzle, wherein, upon distributing the photo resist material, the process further includes dispensing the solvent from the first nozzle for edge bead removal and dispensing the solvent from the second nozzle for cleaning the back of the wafer.

23. (New) The apparatus of claim 19, wherein the solvent further includes aliphatic esther, and wherein a ratio of the diacetone alcohol and aliphatic esther ranges between 10% esther and 90% alcohol to 30% esther and 70% alcohol.

24. (New) An apparatus, comprising:

a solvent dispense head in fluid communication with a source of a photo resist solution and further in fluid communication with a solvent source containing a solvent that includes diacetone alcohol, wherein the solvent dispense head includes:

a first nozzle in fluid communication with the source of the photo resist solution;

a second nozzle in fluid communication with the source of the photo resist solution; and

a third nozzle in fluid communication with the solvent source; and

a rotatable wafer-holding mechanism; and

a logic control unit adapted for executing a process to coat a wafer, wherein the process comprises:

distributing the solvent on a wafer surface using the third nozzle; and

upon distributing the solvent, distributing the photo resist solution on the wafer surface using the first and second nozzles.

25. (New) The apparatus of claim 24, wherein:

the first nozzle and the second nozzle are in fluid communication with the solvent source; and

the process executed by the logic control unit further comprises, upon distributing the photo resist solution, dispensing the solvent on the wafer using the first and second nozzles.

26. (New) The apparatus of claim 24, wherein, in the process performed by the logic control unit, distributing the solvent on the wafer surface comprises:

dispensing the solvent on the wafer surface; and

actuating the rotatable wafer-holding mechanism to spin the wafer until the prewet solvent is distributed across the wafer surface.

27. (New) The apparatus of claim 24, wherein, in the process performed by the logic control unit, distributing the photo resist solution on the wafer surface comprises:

dispensing the photo resist solution on the wafer; and

actuating the rotatable wafer-holding mechanism to spin the wafer until the photo resist solution is distributed across the wafer surface.

28. (New) An apparatus, comprising:

a rotatable base for holding a wafer;

a solvent dispense head in fluid communication with a source of a photo resist solution and in fluid communication with a solvent source containing a solvent that includes diacetone alcohol;

solenoids for controlling flow of the photo resist solution and the solvent through the solvent dispense head; and

a logic control unit coupled to the solenoids and adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the solvent on a wafer surface;

spinning the wafer on the rotatable base until the solvent is distributed across the wafer surface;

dispensing the photo resist solution on the wafer; and

spinning the wafer until the photo resist solution is distributed across the wafer surface.

29. (New) The apparatus of claim 28, wherein:

the photo resist solution comprises a resin, a photoactive compound and a photo resist solvent; and

the photo resist solvent contained within the photo resist solution includes the solvent from the solvent source.

30. (New) The apparatus of claim 28, wherein the solvent dispense head includes:

a first nozzle in fluid communication with the source of the photo resist solution and directed at the top of the wafer;

a second nozzle in fluid communication with the source of the photo resist solution and directed at the back of the wafer; and

a third nozzle in fluid communication with the solvent source directed at the center of the wafer.

31. (New) The apparatus of claim 28, wherein the process adapted to be executed by the logic control unit further includes dispensing solvent for edge bead removal after the photo resist solution is distributed across the wafer surface.

32. (New) An apparatus, comprising:

a rotatable base for holding a wafer;

a solvent dispense head, including:

a first nozzle in fluid communication with a source of a photo resist solution;

a second nozzle in fluid communication with the source of the photo resist solution; and

a third nozzle in fluid communication with a solvent source containing a

solvent that includes diacetone alcohol;

solenoids for controlling flow through the first nozzle, the second nozzle and the third nozzle; and

a logic control unit coupled to the solenoids and adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the solvent on a wafer surface using the third nozzle;

spinning the wafer on the rotatable base until the solvent is distributed across the wafer surface;

dispensing photo resist solution on the wafer using the first nozzle and the second nozzle; and

spinning the wafer until the photo resist solution is distributed across the wafer surface.

33. (New) The apparatus of claim 32, wherein the third nozzle is directed at the center of the wafer.

34. (New) The apparatus of claim 32, wherein:

the first nozzle is directed at the edge and sides of the wafer;

the second nozzle is directed at the back of the wafer;

the first nozzle is in fluid communication with the solvent source;

the second nozzle is in fluid communication with the solvent source; and

the process executed by the logic controller further includes:

dispensing solvent through the first nozzle for edge bead removal; and

dispensing solvent through the second nozzle on the back of the wafer to clean the wafer.

35. (New) The apparatus of claim 32, wherein the source of photo resist solution includes a photo resist solvent, and wherein the source of the solvent and the photo resist solvent are from a common bulk solvent.

36. (New) The apparatus of claim 32, wherein:

the photo resist solution comprises a resin, a photoactive compound and a photo resist solvent; and

the photo resist solvent contained within the photo resist solution includes the solvent from the solvent source.

37. (New) An apparatus, comprising:

a rotatable base for holding a wafer;

a solvent dispense head in fluid communication with a source of a photo resist solution and a bulk solvent that includes diacetone alcohol;

solenoids for controlling flow of the photo resist solution and the bulk solvent through the solvent dispense head; and

a logic control unit coupled to the solenoids and adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the bulk solvent on a wafer surface;

spinning the wafer on the rotatable base until the bulk solvent is distributed across the wafer surface;

dispensing the photo resist solution on the wafer; and

spinning the wafer until the photo resist solution is distributed across the wafer surface.

38. (New) The apparatus of claim 37, wherein approximately 70% of the bulk solvent is diacetone alcohol.

39. (New) The apparatus of claim 37, wherein approximately 90% of the bulk solvent is diacetone alcohol.

40. (New) The apparatus of claim 37, wherein between 70% and 90% of the bulk solvent is diacetone alcohol.

41. (New) The apparatus of claim 37, wherein:

the photo resist solution comprises a resin, a photoactive compound and a photo resist solvent; and

the photo resist solvent contained within the photo resist solution includes the bulk solvent source.

42. (New) An apparatus, comprising:

a rotatable base for holding a wafer;

a solvent dispense head in fluid communication with a source of a photo resist solution and a bulk solvent that includes a mixture of diacetone alcohol and aliphatic esther;

solenoids for controlling flow of the photo resist solution and the bulk solvent through the solvent dispense head; and

a logic control unit coupled to the solenoids and adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the bulk solvent on a wafer surface;

spinning the wafer on the rotatable base until the bulk solvent is distributed across the wafer surface;

dispensing the photo resist solution on the wafer; and

spinning the wafer until the photo resist solution is distributed across the wafer surface.

43. (New) The apparatus of claim 42, wherein the mixture of diacetone alcohol and aliphatic esther includes a ratio that ranges between 10% esther and 90% alcohol to 30% esther and 70% alcohol.

44. (New) A system for coating a wafer, comprising:

a bulk solvent container, wherein a bulk solvent contained therein includes diacetone alcohol;

a low pressure canister connected to the bulk solvent container; and

a track coating unit connected to the low pressure canister, the track coating unit

comprising:

a solvent dispense head;

a rotatable base for mounting the wafer; and

a logic control unit adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the bulk solvent on a wafer surface;

spinning the wafer on the rotatable base until the bulk solvent is distributed across the wafer surface;

dispensing photo resist solution on the wafer; and

spinning the wafer until the photo resist solution is distributed across the wafer surface.

45. (New) The system of claim 44, wherein the bulk solvent further comprises aliphatic esther.

46. (New) The system of claim 44, wherein the bulk solvent comprises aliphatic esther and diacetone alcohol mixed in a ratio that ranges between 10% esther and 90% alcohol to 30% esther and 70% alcohol.

47. (New) The system of claim 44, wherein the low pressure container is adapted to maintain proper fluid pressure and level for the track coating unit.

48. (New) A system for coating a wafer, comprising:

a bulk solvent container, wherein a bulk solvent contained therein includes diacetone alcohol and aliphatic esther;

a low pressure canister connected to the bulk solvent container; and

a track coating unit connected to the low pressure canister, the track coating unit comprising:

a solvent dispense head;

a rotatable base for mounting the wafer; and

a logic control unit adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the bulk solvent on a wafer surface;

spinning the wafer on the rotatable base until the bulk solvent is distributed across the wafer surface;

dispensing photo resist solution on the wafer; and

spinning the wafer until the photo resist solution is distributed across the wafer surface.

49. (New) The system of claim 48, wherein the bulk solvent includes a mixture of the aliphatic esther and the diacetone alcohol that ranges between 10% esther and 90% alcohol to 30% esther and 70% alcohol.

50. (New) The system of claim 48, wherein the aliphatic esther and the diacetone alcohol are mixed in a ratio of approximately 10% esther and 90% alcohol.

51. (New) The system of claim 48, wherein the aliphatic esther and the diacetone alcohol are mixed in a ratio of approximately 30% esther and 70% alcohol.

52. (New) The system of claim 48, wherein the aliphatic esther is approximately 10% of the prewet solvent.

53. (New) The system of claim 48, wherein the aliphatic esther is approximately 30% of the prewet solvent.

54. (New) The system of claim 48, wherein the aliphatic esther is between 10% and 30% of the prewet solvent.

55. (New) The system of claim 48, wherein the diacetone alcohol is approximately 70% of the prewet solvent.

56. (New) The system of claim 48, wherein the diacetone alcohol is approximately 90% of the prewet solvent.

57. (New) The system of claim 48, wherein the diacetone alcohol is between 70% and 90% of the prewet solvent.

58. (New) A system for coating a wafer, comprising:

a bulk solvent container, wherein a bulk solvent contained therein includes diacetone alcohol; and

a track coating unit coupled to the bulk solvent container, the track coating unit comprising:

a solvent dispense head;

a rotatable base for mounting the wafer; and

a logic control unit adapted for executing a process to coat a wafer, wherein the process comprises:

dispensing the bulk solvent on a wafer surface;

spinning the wafer on the rotatable base until the bulk solvent is distributed across the wafer surface;

dispensing photo resist solution on the wafer;

spinning the wafer until the photo resist solution is distributed across the wafer surface; and

dispensing the bulk solvent on the edge and sides of the wafer and on the back of the wafer for edge bead removal and cleanup after distributing the photo resist.

59. (New) The system of claim 58, wherein the track coating unit further comprises solenoids coupled to the logic control unit for controlling the flow through the nozzles.

60. (New) The system of claim 58, wherein the bulk solvent further includes aliphatic esther.

61. (New) The system of claim 58, wherein the bulk solvent further includes aliphatic esther to form a mixture that has a ratio between 10% esther and 90% alcohol to 30% esther and 70% alcohol.

Claims 13-61 are now pending in this application. The Examiner is invited to contact the below-signed attorney with nay questions regarding the present application.

Respectfully submitted,

JOHN WHITMAN

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6960

Date 8-29-01 By Marvin L Beek

Marvin L. Beekman
Reg. No. 38,377

"Express Mail" mailing label number: EL873860665US
Date of Deposit: August 29, 2001
This paper or fee is being deposited on the date indicated above with the United States Postal Service pursuant to 37 CFR 1.10, and is addressed to The Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.

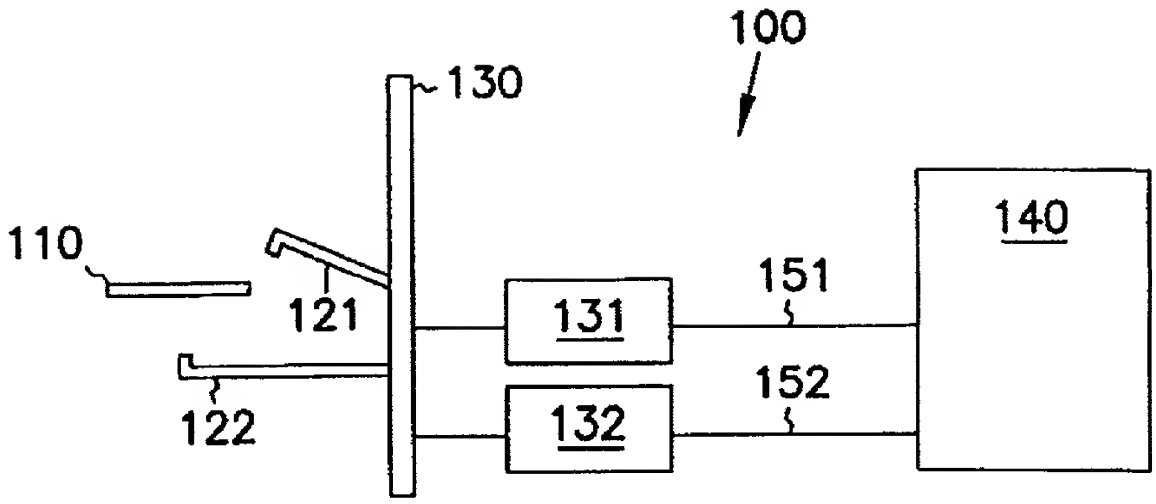

FIG. 1 (PRIOR ART)

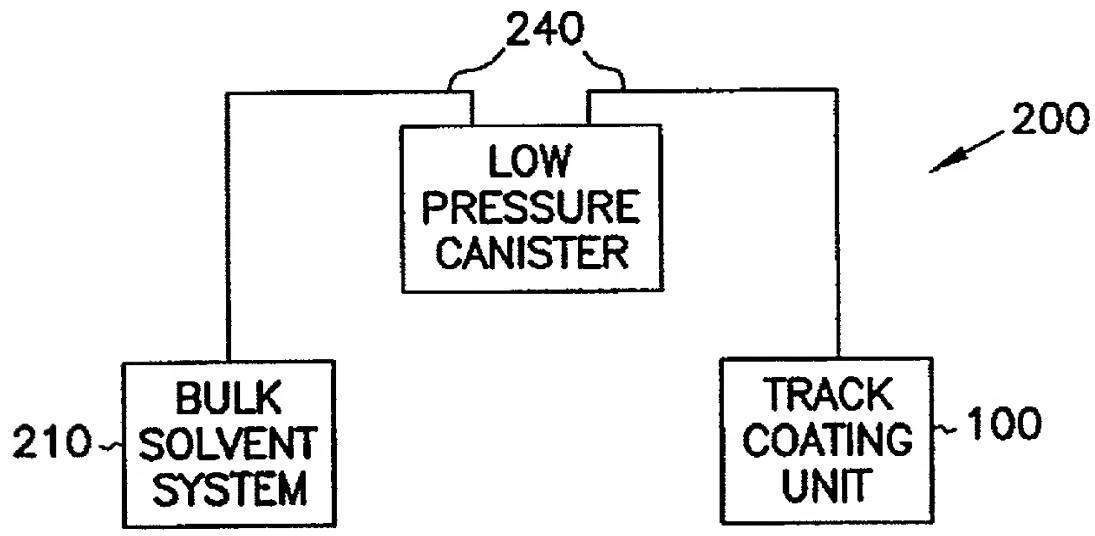

FIG. 2

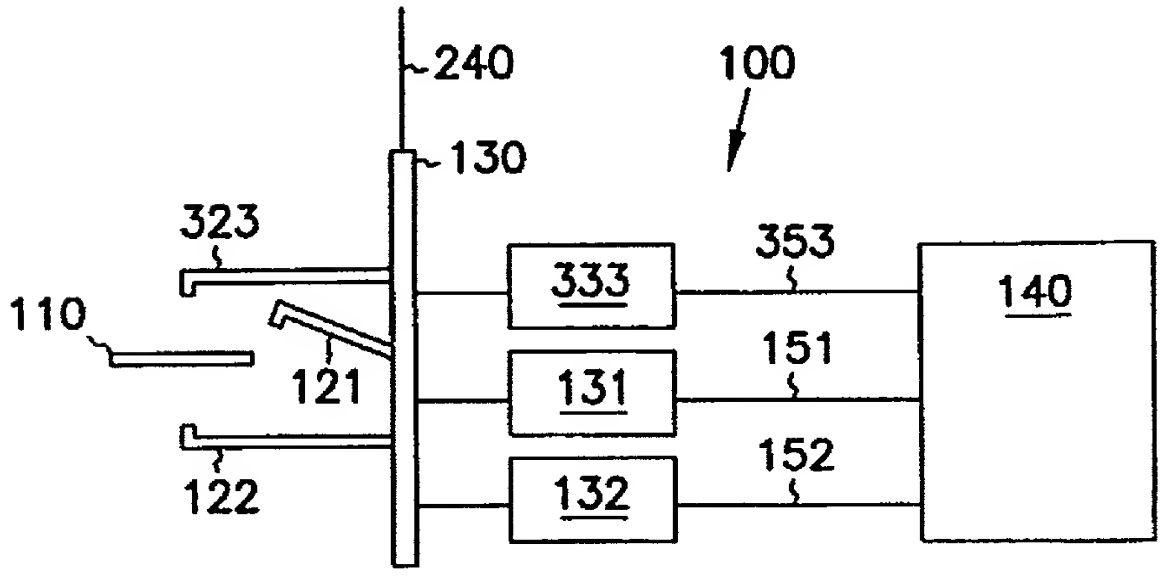

FIG. 3

CLEAN VERSION OF ABSTRACT

A SOLVENT PREWET AND METHOD TO DISPENSE THE SOLVENT PREWET
Applicant: John Whitman
Serial No.: Unknown

Abstract of the Disclosure

A method and apparatus is provided for more efficient application of photoresist to a wafer surface. One aspect of the method comprises applying solvent to the wafer and spinning it to coat the entire wafer surface prior to the application of photoresist. This reduces surface tension on the wafer and reduces the amount of resist required to achieve a high quality film. The apparatus comprises adding a third solenoid and nozzle to the coating unit to accommodate the application of solvent to the center of the wafer surface. The method also describes incorporating a new solvent comprising diacetone alcohol, which is a low-pressure solvent, providing extended process latitudes and reduced material expenditures.

CLEAN VERSION OF AMENDED SPECIFICATION PARAGRAPHS

A SOLVENT PREWET AND METHOD TO DISPENSE THE SOLVENT PREWET
Applicant: John Whitman
Serial No.: Unknown

Paragraph beginning at page 3, line 28:

The photoresist is deposited on each wafer after the wafer is mounted in the process bowl of a track coating unit. One partial solution to controlling the amount of solvent (and other photoresist materials) used is to use a chemical dispensing unit which provides tighter control over the amount of solvent deposited on any one wafer. One such system is described in European Patent 618,504, issued to Hasebe. Hasebe describes a system employing a specialized dispensing head which has a single nozzle for dispensing solvent and a single nozzle for dispensing resist solution. Hasebe controls where the material is dispensed on the wafer by moving the dispense head to different locations relative to the wafer. The system disclosed in Hasebe requires, however, a number of specialized devices, including a moveable dispense head, a pump for the solvent and a temperature adjustment mechanism. This type of system reduces the waste of solvent resulting from over-application, as well as increasing wafer-to-wafer consistency due to the more accurate dispensing of the material. This is only a partial solution, however, because even though a variety of units for dispensing chemicals in this manner are marketed, the units are designed for low volumes of low viscosity fluids. In addition, each unit is a specialized system, so when a shop wishes to employ such a method the shop has to retrofit or replace existing equipment. This results in reduced production flow, and overhead costs are significantly increased.

Paragraph beginning on page 7, line 15:

Conventional processes primarily employ a three-component photoresist, with either ethyl lactate (EL) or propyleneglycol monomethylether acetate (PGMEA) as the preferred solvent component. Both of these substances have a rather high evaporation rate, however, which shrinks the process control window. To compensate, conventional systems use more photoresist as well as a greater percentage of solvent to total photoresist volume. In contrast, according to one aspect of the present invention, a low vapor-pressure solvent is used. In one embodiment a mixture of aliphatic esther and diacetone alcohol is used as the solvent component. The ratio of the materials can range from 10% esther and 90% alcohol, to 30% esther and 70% alcohol. The dissipation rate of this solvent is significantly reduced over

conventional solvents because diacetone alcohol has a heavier molecule, creating a very low pressure solvent. The rate of evaporation is up to ten times lower than that of the conventional solvents. One direct result is that semiconductor processing incorporating this type of solvent requires very little solvent to achieve very good resist thickness profiles. With the diacetone alcohol solvent, the process uses as little as 0.3-1.0 cc solvent prewet solution per wafer (as compared to 1.0 cc or greater solvent solution per wafer).